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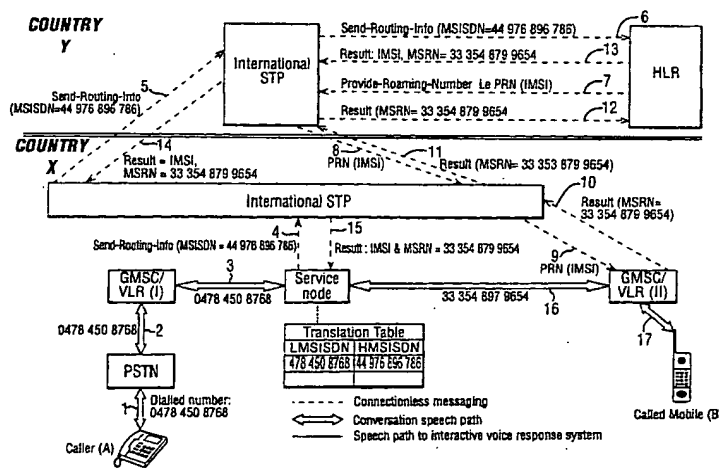
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(54) Title: METHOD AND SYSTEM FOR ROUTING CALLS TO A MOBILE TELECOMMUNICATIONS DEVICE



(57) Abstract: A method of routing calls to a mobile telecommunications device capable of roaming across national boundaries, comprising the steps of: receiving (2), at a mobile telecommunication service provider location, a call destined for a mobile telecommunications device; interrogating (4, 5, 6, 7) a home service provider for the device as to the present location of the device; and routing (16) the call directly from the telecommunications service provider location to the mobile telecommunications device in its present location. The present invention provides a method of routing a call directly to a mobile telephone, or the like, which may have roamed across national boundaries, and a system that enables this method to be carried out.

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METHOD AND SYSTEM FOR ROUTING CALLS TO A MOBILE
TELECOMMUNICATIONS DEVICE

5 The present invention relates to a method of directing a call to a mobile telephone, or the like, directly to that mobile telephone irrespective of its location, and a system that enables this to be carried out. More specifically, the present invention relates to optimising the route which a call, between a mobile telephone and another telephone, travels, when the mobile telephone is not in its home location/country.

10

At present, when an Australian fixed line telephone customer (for example) makes a call to a UK mobile phone service subscriber, who happens to be roaming in Australia, the call is routed from Australia to the UK and back to Australia. This is obviously undesirable, because someone has to pay for the
15 redundant international call. Similarly, if the UK subscriber was in New Zealand and received the same call from the Australian fixed line customer, the call would be routed from Australia to the UK, and then on to New Zealand. Again, the call is routed such that a large part of the International call is redundant, and someone must pay for this redundant transfer of information.

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It is clear that the current situation is less than ideal. The present invention seeks to address this.

In accordance with the present invention there is provided a method of
25 routing calls to a mobile telecommunications device capable of roaming across national boundaries, comprising the steps of: receiving, at a mobile telecommunication service provider location, a call destined for a mobile telecommunications device; interrogating a home service provider for the device as to the present location of the device; and routing the call directly from the
30 telecommunications service provider location to the telecommunications device in its present location.

Preferably, the mobile telecommunications device is assigned a national type number for each nation into which it may roam, and that number may be used to call the mobile device from within that nation. More preferably, a home nation number of the mobile telecommunications device is translated into each of its
5 national equivalents by means of a translation or look-up table. Still more preferably, a number is recognisable as an equivalent of a home nation number by means of a code and/or sequence of digits within the number.

In accordance with a preferred embodiment of the present invention, if, in
10 the step of receiving a call, an equivalent of a home nation number is recognised, the call is trapped and suspended whilst the step of interrogation is carried out.

Preferably, the interrogation of a home service provider includes: translating the number called into its equivalent home nation number; generating
15 and sending, to the home service provider of the mobile telecommunications device associated with that number, a request for the supply of routing information for that device; and receiving a response from the home service provider including a roaming number for the device.

20 Preferably, the home service provider: generates and sends, to a further service provider in the domain of which the device is currently located, a request for the provision of a roaming number for the device; and receives a response therefrom including the requested roaming number. Preferably, the further service provider and the telecommunications service provider are located within the same
25 national boundaries. Alternatively, the further service provider and the telecommunications service provider are located within different sets of national boundaries. Preferably, the home service provider is located within a different set of national boundaries. Still more preferably, the telecommunications service provider and the further service provider are one and the same.

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In a preferred embodiment of the present invention, when a roaming number indicates that the device is in its home location; if the caller is a customer of the telecommunications service provider, the caller is advised of the cost of the

- call if completed and is provided an opportunity to cease the call or to continue; or if the caller is not a customer of the telecommunications service provider, the caller is advised that the call cannot be completed and must be re-commenced using the desired mobile device's home equivalent number, and the call is terminated.
- 5 Preferably, when the roaming number indicates that the device is in neither its home location nor the country in which the call originates, the viability of completing the call to the device location is determined; and if viable, the call is completed; or if not viable; if the caller is a customer of the telecommunications service provider, the caller is advised of the cost of the call if completed and
- 10 provided an opportunity to cease the call or to continue; or if the caller is not a customer of the telecommunications service provider, the caller is advised that the call cannot be completed and must be recommenced using the device's home equivalent number, and the call is terminated.
- 15 Preferably, once the step of interrogation is complete, the call is taken out of suspension. Of course, if a call is not able to be completed, or if the calling party hangs up whilst the call is suspended, the call is merely released.

In a preferred embodiment of the present invention, the step of routing the

20 call comprises sending it to the roaming number provided as a part of the routing information.

Also in accordance with the present invention there is provided a system for recognising and routing calls to a mobile telecommunications device capable of

25 roaming across national boundaries, comprising: means for recognising a call made to a number relating to a roamable device; means for trapping and suspending such a call; means for equating that number with the actual number of the device; means for generating and sending a routing information request, and for receiving a response to the request; and means for releasing and routing the

30 call.

Preferably, the means for equating includes at least one look-up and/or translation table of at least one number relating to a device, the actual number of

the device and a service provider with which the device is registered. More preferably, the mobile telecommunications device is assigned a national number for each nation into which it may roam. Still more preferably, a number is recognisable as an equivalent of a home nation or actual device number by means of a code and/or sequence of digits within a number.

In a preferred embodiment of the invention, the means to carry out the method may be implemented in software. The software causes the stated elements within telecommunications systems to operate in such a way as to carry out the method. Of course, hardware implementation of the invention is also envisioned.

The present invention, referred to herein as the Least Cost Routing (LCR) service, allows mobile phone subscribers to receive calls when roaming abroad without necessarily having to incur international call charges. This is achieved by enabling all calls to a mobile customer that subscribes to the service to be routed to a local mobile network. The local mobile network will then determine the actual location of the mobile and will route the call directly to that location.

Continuing the Example utilised above, a call from an Australian fixed line customer to a UK subscriber, who happens to be roaming in Australia, using LCR, will be routed to the local mobile operator and from there will be routed directly to the called customer. Equally, if the UK roamer was in New Zealand and received the same call from the Australian fixed line customer, then the local mobile operator would route the call directly to New Zealand.

The service is achieved by giving the roamer a permanent and unique number from each country that the customer may visit. This is akin to an AT&T (RTM) number, unique to each country, that can be dialled to get through to an AT&T (RTM) operator for an AT&T (RTM) rated call. Except, in this case the number is dialled by the party attempting to reach the roamer.

This service is defined in the European Telecommunications Standards Institute Global System for Mobile Communications (ETSI GSM) recommendations, but has not been implemented because the way it has been defined in ETSI makes the technical challenges uneconomical to overcome. The method set forth herein is based on, and is compliant to, the GSM Recommendations. However, rather than requiring the development of new platforms and new software, as required in GSM, the method proposed utilises technologies and protocols that exist and are available in all digital mobile networks, independent of the air interface. This makes it extremely economical to develop.

In conclusion, the service is economical, relatively quick and simple to implement and can be used in any GSM, Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) or third generation (3G) network.

A specific embodiment of the present invention is now described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows call routing, according to the present invention, when a caller and called mobile phone are in the same country;

Figure 2 shows call routing, according to the present invention, when a caller and called mobile phone are in different countries;

Figure 3 shows call routing, according to the present invention, when a caller and called mobile phone are in different countries and reduced costs do not apply;

Figure 4 shows a card illustrating a plurality of numbers related to a single number for use with the present invention; and

Figure 5 is a logical sequence diagram detailing the making of a call in at least the scenarios of Figures 1 to 3.

Set forth below is a method by which the present invention (least cost routing) may be realised by GSM operations. The method involves minimal network development or upgrade. The following is in line with, and does not

violate the GSM specifications or any of the GSM Memorandum of Understanding (MoU) stipulations, including those specified by:

- BARG (Billing Accounting Rapporteur Group)
- IREG (International Roaming Expert Group)
- 5 SERG (Services Expert Rapporteur Group)
- TADIG (Transfer Account Data Interest Group)

The principles supporting Least Cost Routing apply equally to 3G, Digital Advance Mobile Phone System (DAMPS), CDMA, and GSM North America
10 Operators.

Least Cost Routing (LCR) is a network feature that enables calls to a mobile subscriber to be routed directly to the mobile subscriber's actual location, instead of via the home Public Land Mobile Network (HPLMN). The Public Land
15 Mobile Network (PLMN) initiating the call decides whether or not to optimise the routing of the call, taking into account information provided by the called mobile subscriber's HPLMN.

A mobile subscribing to the service is permanently assigned a local number
20 from within a range of directory numbers allocated to any or all PLMNs supporting the LCR feature. A call can be terminated to that mobile by any caller dialling the number allocated to that mobile by the PLMN within the country of the Caller. Note that the mobile subscriber may have multiple local numbers, each assigned by the administration supporting the LCR feature.

25

Persons calling mobile customers who have subscribed to the service always dial a national number irrespective of the location of the mobile subscriber, as long as the caller is in a country with an operator that supports the service. The national number assigned to the mobile subscriber may vary from country to
30 country, but the number dialled to reach that customer is always the same in any one country, irrespective of the location of that customer.

The national number assigned to the subscriber is assigned from the number range of the local participating mobile operator. Thus, upon the caller dialling the national number, the call is routed to a mobile switch of the participating local mobile operator. The mobile switch will then access an internal or external translation table to translate the dialled number into the home Mobile Station International Integrated Services Digital Network Number (MSISDN) of the subscribing mobile. This MSISDN will then be used by the local Mobile (Services) Switching Centre/Visitor Location Register (MSC/VLR) to send a Mobile Application Part (MAP) message to the subscriber's Home Location Register (HLR) in order to request routing information necessary to route a call to the called mobile. The HLR will send routing information to the requesting MSC/VLR. This Routing information denotes the current location of the subscriber. The local MSC/VLR receiving the routing information will use this information to route the call from the caller, directly to the mobile network currently supporting the subscriber. Note that, in this case, the call is routed directly from the caller location to the called customer location without the need for the call to be routed via the called customer's home location.

The translation table may be a function of the MSC/VLR, or may be a combined service node and MSC/VLR or, as defined in the remainder of this document, the MSC/VLR and the service node (with translation table) are on separate platforms.

Three call routing scenarios according to the present invention are now described. The first scenario regards a call from a Public Switched Telephone Network (PSTN) customer to an LCR subscriber who has roamed to the same country as the caller. The second scenario regards a call from a PSTN customer to an LCR subscriber who has roamed to a country that is not the same country as the caller. The third scenario regards a call from a PSTN customer to an LCR subscriber who has also roamed to a different country from the location of the caller. However in this third case the Public Land Mobile Network (PLMN) determines that it is not commercially viable to route the call such that the caller simply pays for a national call.

Note that whilst all the calls originate from a PSTN, the scenarios are equally applicable to mobile originated calls, roaming or otherwise.

- 5 The commentary focuses on network interaction to establish the call, and the billing implications of the call. The scenarios given assume a GSM network. However, the principles given in the scenarios are applicable to any second or third generation mobile technology. The billing considerations serve only as examples of what is possible.

10

Scenario 1: Caller and called mobile in same country

Each of the steps in the call routing method set forth below is illustrated, using the same step numerals, in Figure 1.

15

1. A calling party wishing to connect to a mobile that has subscribed to the least cost routing service dials the local number that has been permanently assigned to that roaming mobile by a local PLMN.
- 20 2. The call is routed via the PSTN to the nearest Gateway MSC (I) of the PLMN, referred to by the Mobile Network Code (MNC)(in this example, 0478).
3. The Gateway MSC analyses the dialled digits and, recognising the digits
25 478 45X XXXX as requiring special treatment, initiates an internal trigger which causes the call to be routed to a service node.
4. The service node traps and suspends the call, and performs a number translation to convert the dialled 478 450 8768 to the MSISDN (44 976 896
30 786) of the desired mobile. The service node, acting as an MSC/VLR (but with no radio resource functionality), initiates a Send-Routing-Information message to the HLR of the desired mobile. The message is sent in a

connectionless message, and the sub-system number of the message points to the HLR of the home PLMN.

- 5 5. This message is routed via the international Signalling Transfer Point (STP) of the country of origin and the STP of the country of the home location of the desired mobile.
- 10 6. The STP of the home country performs a Global Title Translation to identify the Destination Point Code, and routes the message, accordingly, to the node supporting the appropriate HLR platform.
- 15 7. The Send-Routing-Information message terminates on the required HLR. The HLR treats this incoming message as it would any other Send-Routing-Information request. In this case the result is a Provide-Roaming-Number message, which is sent to the MSC of the PLMN currently hosting the desired mobile. In this scenario, the visitor MSC is in the same country as the caller.
- 20 8. The Provide-Roaming-Number message proceeds, as normal, through the STP of the home location and the STP of the terminating country.
9. The message terminates on the MSC/VLR of the PLMN currently hosting the LCR subscriber.
- 25 10. The MSC treats the request for a Roaming Number as if normal. In this case, the MSC returns a Roaming Number (RN), also termed a Mobile Services Roaming Number (MSRN), to the HLR.
- 30 11. The RN result message passes through the STPs of the country of the VPLMN and the Home country of the Mobile.
12. The RN result message terminates on the HLR. The HLR then treats this result, or any other result received from the visitor MSC, as normal.

13. In this case, the Roaming Number received is sent from the HLR to the MSC/VLR of the originating PLMN as the response to the Send-Routing-Information message. Included in the response is the International Mobile Subscriber Identity (IMSI) of the desired mobile.

14. The message containing the Roaming Number and IMSI passes through the STPs of the home country and country of origin.

15. The message terminates on the originating PLMN's service node, still acting as an MSC/VLR (but with no radio resource functionality). The service node analyses the received Roaming Number in order to determine which process is to be executed. In this case it is determined that the service node can complete the call to the wanted party.

15

16. Using the received Roaming Number information as routing digits, the service node recognises that the desired mobile is hosted by an MSC within its own PLMN. The service node takes the call out of suspension and routes the call to the MSC, and thus to the desired mobile, indicated by the Roaming Number.

20

The MSC treats the receipt of the call set-up request as per any other call set-up request, regardless of the fact that in this case the origin of the call set-up request is not the Home location of the wanted party. In this case the call is completed to the desired mobile. If the desired mobile was in another PLMN in the same country, then the call would be routed to that PLMN with no change to any other functionality.

25

It is to be noted that when the call is released, the terminating MSC generates a call record that is sent to a local billing system to be rated. The call record will include an originating network identifier. The local billing system then places the rated record in Transfer Account Procedure (TAP) format and sends the result (including the originating network identifier) to the called mobile's home

30

billing system or bureau. The home billing system or bureau recognises that the originating network identifier belongs to the same country as the call termination and rates the call accordingly.

- 5 In this scenario, because the call is routed on a national level only, the calling party need be billed for a national call only, rather than an international call to the home location of the wanted party.

10 The Home Operator may choose how the called party is to be billed. For example, the called party may be billed for an international call from the home location to its current location (as is currently expected) or the called party may be charged a local (national) call only. Alternatively, the called party is not charged for the call.

15

Scenario 2: Called mobile roaming, but not to same country as caller

Each of the steps in the call routing method set forth below is illustrated, using the same step numerals, in Figure 2.

20

1. A Calling Party wishing to connected to a mobile that has subscribed to the least cost routing service dials the local number that has been permanently assigned to that roaming mobile by a local PLMN.
- 25 2. The call is routed via the PSTN to the nearest Gateway MSC (1) of the PLMN referred to by the MNC (in this example, 0478).
3. The Gateway MSC analyses the dialled digits and, recognising the digits 478 45X XXXX as requiring special treatment, initiates an internal trigger which causes the call to be routed to the service node.
- 30 4. The service node traps and suspends the call, and performs a number translation to convert the dialled number 478 450 8768 to the MSISDN (44

- 976 896 786) of the wanted mobile. The service node, acting as MSC/VLR (but with no radio resource functionality), initiates a Send-Routing-Information message to the HLR of the desired mobile. The message is sent in a connectionless message, and the sub-system number of the message points to the HLR of the home PLMN.
- 5
5. This message is routed via the international Signalling Transfer Point (STP) of the country of origin and the STP of the country of the home location of the wanted customer.
- 10
6. The STP of the home country performs a Global Title Translation to identify the Destination Point Code, and routes the message accordingly to the node supporting the HLR platform.
- 15
7. The Send-Routing-Information message terminates on the required HLR. The HLR treats this incoming message as it would any other Send-Routing-Information request. In this case, the result is a Provide-Roaming-Number message, which is sent to the MSC of the PLMN currently hosting the desired mobile.
- 20
8. The Provide-Roaming-Number message proceeds, as normal, through the STP of the home location and the STP of the terminating country.
9. The message terminates on the MSC/VLR of the PLMN currently hosting the customer.
- 25
10. The MSC treats the request for a Roaming Number as normal. In this case, the MSC returns a Roaming Number (RN) to the HLR.
- 30
11. The RN result message passes through the STPs of the country of the visitor PLMN (VPLMN) and the home country of the mobile.

12. The Roaming Number result message terminates on the HLR. The HLR will treat this result, or any other result received from the visitor MSC, as normal.
- 5 13. In this case, the Roaming Number received will be sent from the HLR to the MSC/VLR of the originating PLMN as the response to the Send-Routing-Information message. Included in the response is the IMSI of the desired mobile.
- 10 14. The message containing the Roaming Number and IMSI passes through the STPs of the home country and country of origin.
- 15 15. The message terminates on the originating PLMN's service node, still acting as an MSC/VLR (but with no radio resource functionality). The service node analyses the received Roaming Number in order to determine which process is to be executed. In this case it is determined that the service node can complete the call to the desired mobile.
- 20 16. Using the received Roaming Number information as routing digits, the service node takes the suspended call out of suspension and routes the call to the destination indicated by the Roaming Number.
17. The call is connected through the international gateways of the country of origin and the terminating country.
- 25 18. The call terminates on the MSC/VLR indicated by the Roaming Number originally sent to the desired mobile's HLR.
- 30 19. The MSC treats the receipt of the call set-up request as per any other call set-up request, regardless of the fact that in this case the origin of the call set-up request is not the home location of the desired mobile. In this case the call is completed to the desired mobile.

When the call is released, the terminating MSC generates a call record that is sent to the local billing system to be rated. The call record includes an originating network indicator. The local billing system then places the rated record in TAP format and sends the result (including the originating network indicator) to the called mobile's home billing system or bureau.

The home billing system or bureau recognises that the originating country and terminating country are not the same, and rates the call as a call from the home country to the country of the terminating PLMN. The billing system may additionally place a surcharge on the call as per any call terminating to one of its roaming subscribers. The customer will then be billed accordingly.

In this scenario, the calling party is billed for a national call rather than an international call to the home location of the wanted party. The called party is billed for an international call from the home location to its current location as is expected – even though the call was not routed via the home location. The originating PLMN has the opportunity to route the call via its preferred international carrier. This opportunity would not be present if normal call routing were applied.

Scenario 3: Use of Interactive Voice Response System (IVRS) when called mobile is roaming, but not to the same country as the caller

Each of the steps in the call routing method set forth below is illustrated, using the same step numerals, in Figure 3.

1. A calling party wishing to connect to a mobile that has subscribed to the least cost routing service dials the local number that has been permanently assigned to that roaming mobile by a local PLMN.
2. The call is routed via the PSTN to the nearest Gateway MSC (I) of the PLMN, referred to by the mobile network code (in this example, 0478).

3. The Gateway MSC analyses the dialled digits and, recognising the digits 478 45X XXXX as requiring special treatment, initiates an Internal trigger which causes the call to be routed to the service node.
- 5 4. The service node traps and suspends the call, and performs a number translation to convert the dialled 478 450 8768 to the MSISDN (44 976 896 786) of the desired mobile. The service node, acting as an MSC/VLR (but with no radio resource functionality), initiates a Send-Routing-Information message to the HLR of the wanted mobile. The message is sent in a connectionless message, and the sub-system number of the message points to the HLR of the home PLMN.
- 10 5. This message is routed via the international Signalling Transfer Point (STP) of the country of origin, and the STP of the country of the home location of the desired mobile.
- 15 6. The STP of the home country performs a Global Title Translation to identify the Destination Point Code, and routes the message accordingly to the node supporting the HLR platform.
- 20 7. The Send-Routing-Information message terminates on the required HLR. The HLR treats this incoming message as it would any other Send-Routing-Information request. In this case, the result is a Provide-Roaming-Number message, which is sent to the MSC of the PLMN currently hosting the desired mobile.
- 25 8. The Provide-Roaming-Number message proceeds as normal through the STP of the home location and the STP of the terminating country.
- 30 9. The message terminates on the MSC/VLR of the PLMN currently hosting the desired mobile.

10. The MSC treats the request for a Roaming Number as normal. In this case, the MSC returns a Roaming Number (RN) to the HLR.
11. The RN result message passes through the STPs of the country of the VPLMN and the home country of the mobile.
12. The RN result message terminates on the HLR. The HLR treats this result, or any other result received from the visitor MSC, as normal.
13. In this case, the Roaming Number received is sent from the HLR to the MSC/VLR of the originating PLMN as the response to the Send-Routing-Information message. Included in the response is the IMSI of the desired mobile.
14. The message containing the Roaming Number and IMSI passes through the STPs of the home country and the country of origin.
15. The message terminates on the originating PLMN's service node, still acting as an MSC/VLR (but with no radio resource functionality). The service node analyses the received Roaming Number in order to determine which process is to be executed.
16. Upon analysing the Roaming Number, the service node determines that the call cannot be completed without, as a minimum, further interaction with the Calling Party.
 - 16.1 If the service node determines that the Roaming Number indicates that the desired mobile is in its home location, then:
 - 16.1.1 If the caller is not a customer of the PLMN, the service node instructs the IVRS to inform the caller that the call cannot be completed as dialled, and that the caller must disconnect and redial

using the home MSISDN of the desired mobile. In this case the call must be completed without the benefit of LCR.

5 16.1.2 If the caller is a customer of the PLMN, the service node instructs the IVRS to inform the caller that the call cannot be completed as a national call and, if the caller stays on the line, the call will be completed and charged as an international call to the point of termination. The caller is also given the option to disconnect and redial using the home MSISDN of the wanted mobile. If this
10 option is taken, the call is completed without the benefit of LCR.

16.2 The service node may determine that the Roaming Number indicates that the desired mobile is in a location that is not its home country or the local country (i.e. the country of origination of the call). In this case,
15 the service node additionally determines whether the country indicated by the Roaming Number is one to which it is commercially viable for the PLMN to complete the call and still have the caller charged for a national call (i.e. one which utilises LCR).

20 16.2.1 If the service node determines that it is commercially viable to complete the call with the caller being charged for a national call, the call will be completed as per Scenario 2.

25 16.2.2 If the service node determines that it is not commercially viable to complete the call with the caller being charged for a national call, then the service node will invoke the services of the IVRS, and sub-sections 16.1.1 or 16.1.2 are invoked, as appropriate.

30 17. Using the received Roaming Number information as routing digits, the service node takes the call out of suspension and routes the call to the destination indicated by the Roaming Number. This stage obviously only

occurs if the call is to be continued using LCR, as determined in step 16 above.

18. The call is connected through the international gateways of the country of origin and the terminating country.
 19. The call terminates on the MSC/VLR indicated by the Roaming Number originally sent to the desired mobiles.
 20. The MSC treats the receipt of the call set-up request as per any other call set-up request, regardless of the fact that in this case the origin of the call set-up request is not the home location of the desired mobile. In this case, the call is completed to the desired mobile.
- When the call is released, the terminating MSC generates a call record that is sent to the local billing system to be rated. The call record includes the calling party number. In the case where this number is not available, the MSC will insert a dummy local number. The local billing system then places the rated record in TAP format and sends the result (including the calling party number) to the called mobile's home billing system or bureau.

The home billing system or bureau may rate the call as a call from the home country to the country of the terminating PLMN. The billing system may additionally place a surcharge on the call as per any call terminating to one of its roaming subscribers. The customer will then be billed accordingly.

In this scenario, the calling party has accepted a request that he pay for an international call. The local PLMN will therefore bill the customer for an international call. It is an open consideration as to whether the caller is informed and billed for a call to the home location of the customer, or for a call to the actual location of the customer.

The called party may be billed for an international call from the home location to its current location as is expected – even though the call was not routed via the home location. The originating PLMN has the opportunity to route the call via its preferred international carrier. This opportunity would not be present if normal call routing were applied.

Referring now to the numbering of devices which are subscribed to LCR, each participating network operator reserves one or more blocks of numbers from within its assigned number range to be used exclusively by foreign mobiles subscribing to the service. This participating network operator apportions a part of the reserved blocks of numbers for each of the other participating network operators. Each participating network operator, on receiving their portion of the reserved block of numbers, assigns a number from this range to each of its mobile subscribers who have registered for the service.

15

The net result of the above process is that each participating mobile operator will receive a number of reserved blocks of numbers, one block from each of the other participating mobile operators. Each mobile operator is then able to assign a series of numbers to each subscribing customer, one number from each of the received blocks of numbers. Each of the received numbers is stored in a database, and various of the numbers are also stored in various translation tables, dependent upon the country of the translation table, as set out below.

25

On receipt of his assigned series of numbers, the subscriber is at liberty to advertise these assigned numbers to potential callers. Each potential caller is to receive the number that has been assigned by the mobile operator that operates in the country of the caller. For example, each business subscriber with a business card may have each of their national type local numbers printed on the back of the business card, each number being associated with the country from which that number can be called. Such a card may be seen in Figure 4. As may be seen, the person whose card is shown has subscribed to services from participating

30

mobile operators in the UK, France, South Africa, Singapore, Australia, Malaysia and Hong Kong.

- 5 The numbers within each block of numbers should be contiguous to facilitate minimal number analysis to identify the number assigned to an LCR subscriber. Typically the number range shall be uniquely identifiable from the first two digits following the PLMN network identification code.

e.g: Mobile Directory Number (MSISDN): 0ABC DE FGHIJ

10

where ABC is the mobile network identification code (MNC)
DE identifies an LCR number range
FGHIJ uniquely identifies an LCR customer

- 15 The example above is given for illustrative purposes only. The nature of the directory number of PLMNs may vary as required.

The translation tables, for three exemplary PLMNs (A, B and C), set forth below give an example of translation tables for three separate mobile networks participating in the LCR service. The diagrams show a subset of the translation tables, and depict Local MSISDNs (LMSISDNs) that have been assigned by the PLMNs to mobiles from home PLMNs (HPLMNs) D and E. As may be seen, the tables also include the home MSISDNs of the mobiles.

25 Translation Table of PLMN A

MNC = 0363

LCR Id = 45

LMSISDN	HMSISDN
0363 456 2789	44 790 345 3876
0363 458 6693	44 790 234 1456
0363 459 6634	33 809 756 9450

Translation Table of PLMN B

MNC = 0822

LCR Id = 78

5

LMSISDN	HMSISDN
0822 786 6459	44 790 345 3876
0822 784 7568	44 790 234 1456
0822 785 6619	33 809 756 9450

Translation Table of PLMN C

MNC = 0242

10 LCR Id = 63

LMSISDN	HMSISDN
0242 634 9879	44 790 345 3876
0242 639 8011	44 790 234 1456
0242 630 7766	33 809 756 9450

HPLMN D

15 Country code = 44

MNC = 0790

Directory Numbers of Customer X

HMSISDN = 44 790 345 3876
LMSISDN of PLMN A = 0363 456 2789
LMSISDN of PLMN B = 0822 786 6459
LMSISDN of PLMN C = 0242 634 9879

Directory Numbers of Customer Y

HMSISDN = 44 790 234 1456
LMSISDN of PLMN A = 0363 458 6693
LMSISDN of PLMN B = 0822 784 7568
LMSISDN of PLMN C = 0242 639 8011

HPLMN E

5

Country code = 33

MNC = 0809

Directory Number of Customer Z

HMSISDN = 33 809 756 9450
LMSISDN of PLMN A = 0363 459 6634
LMSISDN of PLMN B = 0822 785 6619
LMSISDN of PLMN C = 0242 630 7766

10

Taking customer X as an example; this customer is from a country whose country code is +44 and whose mobile operator's network code is 0790. This mobile network operator has assigned customer X with a directory number (MSISDN) of 0790 345 3876. The Mobile Operator has also acquired LMSISDNs from PLMN A, B and C, and has assigned customer X with 0363 456 2789, 0822 786 6459 and 0242 634 9879 (received from PLMNs A, B and C respectively).

PLMN A has, in turn, assigned 0363 456 2789 to be translated to the MSISDN of Customer X, namely +44 790 345 3876. Thus any caller from the country of PLMN A wishing to call customer X, will dial 0363 456 2789. The call will be routed to PLMN A, which in turn will translate this number into MSISDN of Customer X. PLMN A will then use this number to interrogate the HPLMN to determine the current location of Customer X.

25

Note that PLMN B and PLMN C have also assigned LMSISDNs to Customer X; namely 0822 786 6459 and 0242 634 9879 respectively.

The same principle can be followed for Customer Y and Customer Z. Note
5 that in this example, Customer Y is from the same PLMN as Customer X; and
Customer Z is from a different PLMN.

The execution of each call scenario set forth above is described below with
reference to the detailed logical sequence diagram of Figure 5.

10

An LCR subscriber may be reached using one of two dialling methods,
irrespective of the actual location of the subscriber.

Firstly, in the case where the called customer's registered home location is
15 not in the same country as the caller: the caller always has the option of dialling
the wanted customer's home MSISDN, preceded by the international access and
country code (the caller will then be charged at the normal tariff); the caller may
dial the local MSISDN that has been assigned to the called subscriber by the local
PLMN operator that supports the LCR service; and, in the case where a caller is in
20 a country that does not support LCR, the caller may dial an MSISDN of the desired
mobile (preceded by the international access code and country code), where the
MSISDN dialled is that assigned to the desired mobile subscriber by any foreign
PLMN operator that supports the service. For example, if a PLMN in Bulgaria
supports LCR, but a PLMN in Romania does not, then a Romanian PSTN
25 customer wishing to call a UK mobile may make an international call into the
Bulgarian PLMN by dialling the wanted customer's local (Bulgarian) MSISDN
preceded by the international code for Bulgaria.

This last option is a viable alternative to dialling the home MSISDN, when
30 the cost of the call to a foreign PLMN supporting the LCR service (but which is not
the home PLMN) is cheaper than dialling the home PLMN. In this case the called
subscriber will be required to pay for the cost of the call from Bulgaria to the UK.
Prior to call completion, the home PLMN is required to inform the called subscriber

of the cost of the call, and the called subscriber is required to signal acceptance of the charges in order that call completion is carried out.

Secondly, in the case where the called customer's registered home location
5 is in the same country as the caller then the caller must dial the wanted party's home MSISDN.

Referring now to Figure 5, if a caller dials an LCR subscriber (Function box 500) and that call is a national call to a mobile network supporting LCR (Function
10 box 502), the call is routed to a local mobile network supporting LCR (Function box 504). The local mobile network then interrogates the dialled number and determines whether the called mobile is an LCR subscriber (Function box 506). The network then translates the dialled number into the MSISDN of the LCR
15 subscriber (Function box 508) and uses that to interrogate the HPLMN of the LCR subscriber as to the whereabouts of that subscriber (Function box 508). It is then determined (Function box 512) whether the LCR subscriber has roamed to the local country of the caller.

If it has not, it can be seen that if the caller subscribes to a mobile network
20 that supports LCR, the routing continues (Function box 514), otherwise the caller is requested to redial using the MSISDN of the desired mobile (Function box 516).

If the routing continues, it is determined (function box 518) whether the desired mobile is in its home country. If it is, the caller is informed that the call will
25 be charged at an appropriate rate for call completion to the home country of the desired mobile (Function box 520). If the caller then requests call completion (Function box 522), the call is routed to the home country of the desired mobile (Function box 524) where the HPLMN completes the call to the desired mobile (Function box 526). The caller is then charged, by the VPLMN, for an international
30 call to the subscriber's home country (function box 528). The LCR subscriber may either be charged for a national call, or not charged at all (Function box 530). Of course, if the caller doesn't request call completion (Function box 522) the call is terminated (Function box 532).

If it is determined that the LCR subscriber is not in their home country (Function box 518), it is determined whether the mobile network in whose area of coverage the subscriber is currently located supports LCR (Function box 534). If it does, the cost of routing the call to the desired destination is determined (Function box 536), the economic viability of such routing is determined (Function box 538) and if the call is viable (Function box 540), it is routed to the desired destination (Function box 542). The LCR subscriber is notified, prior to picking up the call, of the fixed line cost for receiving the call (Function box 544) and if this cost is accepted (Function box 546), the call is completed (Function box 548). Of course, if the charges are not accepted (Function box 546), the call is terminated (Function box 550).

If it is determined that the call is not economically viable (Function box 540), the caller is informed that the call will be completed at the appropriate rate for call completion to the LCR subscriber's home country (Function box 552). If the caller then requests completion (Function box 556), the call is routed to the desired mobile's home country (Function box 556) and the HPLMN completes the call (Function box 558). The caller is then charged by the VPLMN for an international call to the LCR subscriber's home country (Function box 560) and the LCR subscriber is charged for the cost of a call from their home country to their present location (Function box 562). Of course, if the caller doesn't request completion (Function box 554), the call is terminated (Function box 564).

If it is determined (Function box 534) that the mobile network in which the desired mobile is currently located does not support LCR, the same procedure as when a call is not economically viable is followed.

If it is determined that the desired LCR subscriber has roamed to a local country (Function box 512), the call is completed (Function box 566) and the LCR subscriber is either charged for receiving a national call or is not charged (Function box 568). The caller is charged the cost of a call to the mobile network, supporting LCR, in which the desired mobile is located (Function box 570).

If the caller dials the LCR subscriber (Function box 500) and that call is an international call to the HPLMN of the LCR subscriber (Function box 572), the call is routed via the local international operator to the HPLMN (Function box 574).
5 The HPLMN determines the location of the desired subscriber (Function box 576) and the call is completed (Function box 578). The caller is then charged for a call to the HPLMN of the LCR subscriber (Function box 580). If the LCR subscriber is in their home location (Function box 582) they are charged for receiving a national call or are not charged (Function box 584). If the LCR subscriber is not in their
10 home location, they are charged for an international call from their home location to their current location (Function box 586).

Finally, if the caller dials the LCR subscriber (Function box 500) and the caller is in the home location of the LCR subscriber (Function box 588), if the caller
15 dials the MSISDN of the subscriber the call is routed to the HPLMN operator (Function boxes 590, 592) which then deals with the call as described above. However, if the caller dials an equivalent of the MSISDN, the call is terminated (Function boxes 590, 594).

20 Referring now to the functionality of an MSC/VLR, when a caller dials an LCR number, the PSTN routes the call to the participating local mobile operator. The Gateway MSC of the local mobile operator analyses the incoming call to determine whether the number dialled is that of an LCR subscriber. If the dialled number is an LCR number, a trigger in the MSC is activated to cause the call to be
25 routed to a service node for call treatment.

The required trigger is standard functionality currently available on all MSCs. The MSC analyses the first six to ten digits of the dialled number to determine whether the call is to be routed to the service node. Of course, other
30 means of recognition may equally be employed.

As has already been stated, it is assumed that the Gateway MSC/VLR does not carry out the additional number translation functionality. This discussion

assumes that the service node will perform this functionality. It is recognised however that the MSC/VLR may carry out this function.

- Referring now to HLR functionality, the HLR is configured to receive a
- 5 Send-Routing-Information query from any foreign PLMN with which the required agreement exists. On receipt of such a query, the HLR performs the normal functions required to complete the call (including sending a Provide-Roaming-Number query to the MSC/VLR in the VPLMN). The HLR responds by sending a return result, containing the Routing Number, to the PLMN that originated the
- 10 Send-Routing-Information query.

The service node has a number of functions. These are as follows:

- 1) To perform a number translation, from the dialled number to the MSISDN of
15 the LCR subscriber. Note that the translation table will have been populated with the LCR number and MSISDN of the mobile at the time the mobile subscribed for the service.
- 2) To act as an MSC/VLR and use the LCR subscriber's MSISDN to send a
20 Sending-Routing-Information query to the LCR subscriber's HLR, as specified in GSM Recommendation 09:02 Section 8.3. (For ANSI IS41, see TIA PN-2991.3 Section 4.20 Origination Request).
- 3) To receive the Roaming Number from the HLR and
25
 - a) If the received Roaming Number is a national number (i.e. the called subscriber is in the same country as the caller), complete the call to that number.
 - b) If the Roaming Number is a number of the HPLMN (i.e. the called
30 subscriber is in his home location) then
 - i) if the calling party is a customer of the local PLMN, play an announcement to the customer. The customer is requested, through

the use of an IVRS, or a text-based interaction or the like, to decide whether to allow the PLMN to complete the call to the wanted party (and be charged the international rate for completing the call) or whether to hang-up and redial using the home MSISDN of the wanted party. Of course text based or other such interaction may replace the use of IVRS in any of the embodiments set forth in this document.

ii) if the calling party is not a customer of the PLMN, the caller is requested to hang-up and redial using the home MSISDN of the wanted party.

c) if the Roaming Number is to a foreign destination that is not the home location of the called subscriber, then the service node may perform a cost benefit analysis from a look-up table. The look-up table analysis will determine whether it is economically viable to route the call to the LCR subscriber, with the caller possibly paying the cost of a national call and the LCR subscriber paying the cost of a call from his home location to his current location. If the result of the look-up shows that direct routing is economically viable, the call is completed. If the result of the look-up shows that direct routing is uneconomical then:

i) if the calling party is a customer of the local PLMN, the PLMN will play or provide an announcement to the caller. The customer is requested to decide whether to allow the local PLMN to complete the call to the desired mobile, and be charged the international rate for completing the call, or whether to hang-up and redial using the home MSISDN of the LCR subscriber.

ii) if the calling party is not a customer of the local PLMN, the caller is requested to hang-up and redial using the MSISDN of the wanted party.

The terminating MSC/VLR of the VPLMN generates the call record to be rated and converted to TAP by the VPLMN billing system. The TAP record is then sent to the home PLMN or billing bureau where surcharges may be applied for customer billing.

5

The TAP mobile terminated call detail format shall be that specified in the MoU documents TD.17. (TAP Data Record Format: Version 2 for GSM, and CIBER for ANSI IS41). Specifically, the TAP record includes the originating network field. This field has been included in TAP format 2 and 3 for optimum routing purposes, and specifically for the identification of the network and country from which the call has originated.

15 The HPLMN uses the originating network information to determine whether the call originated and terminated in the same country. If this is the case then the customer may not be billed for any portion of the call. If the call originated and terminated in different countries, the customer may be billed for a call from his/her home country to the country where the call terminated.

20 When a customer signs up for the LCR Service, the home PLMN raises a service order to inform all other Participating PLMNs of the service request. The service order includes the mobile's home MSISDN and the assigned LMSISDN taken from the range of LMSISDNs. Each participating PLMN need only receive the (home) MSISDN of the subscriber and a single LMSISDN from the range of Local MSISDNs originally allocated to the HPLMN by the relevant participating PLMN. Not the full range of LMSISDNs assigned to the subscriber by its home Location.

30 The home PLMN changes the tariff plan/rating table of the subscriber to reflect that received TAP records for this mobile are to be rated according to the LCR tariff plan.

On receipt of a service order containing the home MSISDN and the LMSISDN, the receiving participating PLMN activates the service by entering the

home MSISDN against the relevant LMSISDN in a translation table. The receiving PLMN acknowledges receipt and activation of the service order.

5 A central customer service centre may be made responsible for collecting, collating, distributing and ongoing management of LMSISDNs. Alternatively, each participating PLMN may become a member of a network of service centres, each responsible for notifying the others of new LMSISDNs to be assigned against LCR subscriber MSISDNs. Each Service Centre may then respond with an assigned LMSISDN to be given to the LCR subscriber.

10

It will of course be understood that the present invention has been described above by way of example only, and that modifications of detail may be made within the scope of the invention.

CLAIMS:-

1. A method of routing calls to a mobile telecommunications device capable of roaming across national boundaries, comprising the steps of:
receiving, at a mobile telecommunications service provider location, a call
5 destined for a mobile telecommunications device;
interrogating a home service provider for the device as to the present location of the device; and
routing the call directly from the telecommunications service provider location to the mobile telecommunications device in its present location.
- 10 2. A method as claimed in claim 1, wherein the mobile telecommunications device is assigned a national type number for each nation into which it may roam, and wherein that number may be used to call the mobile device from within that nation.
- 15 3. A method as claimed in claim 2, wherein a home nation number of the mobile telecommunications device is translated into each of its foreign national equivalents by means of one or more translation and/or look-up table.
- 20 4. A method as claimed in claim 3, wherein a dialled number is recognisable as an equivalent of a home nation number by means of a code and/or sequence of digits within the number.
5. A method as claimed in claim 4, wherein, in the step of receiving a call, if an
25 equivalent of a home nation number is recognised the call is trapped and suspended whilst the step of interrogation is carried out.
6. A method as claimed in any of claims 3 to 5, wherein the interrogation of a home service provider includes:
30 translating the number called into its equivalent home nation number;
generating and sending, to the home service provider of the mobile device associated with that number, a request for the supply of routing information for that device; and

receiving a response from the home service provider including a roaming number for the device.

7. A method as claimed in claim 6, wherein the home service provider:
5 generates and sends, to a further service provider in the domain of which the device is currently located, a request for the provision of a roaming number for the device; and receives a response therefrom including the requested roaming number.

10 8. A method as claimed in claim 7, wherein the further service provider and the telecommunications service provider are located within the same national boundaries.

9. A method as claimed in claim 7, wherein the further service provider and
15 the telecommunications service provider are located within different sets of national boundaries.

10. A method as claimed in claim 8 or 9 wherein the home service provider is located within a different set of national boundaries.

20

11. A method as claimed in claim 8, wherein the telecommunications service provider and the further service provider are one.

12. A method as claimed in claim 6 or claim 7, wherein when the roaming
25 number indicates that the device is in its home location:

if the caller is a customer of the telecommunications service provider, advising the caller of a cost of the call if completed and providing an opportunity to cease the call or to continue; or

if the caller is not a customer of the telecommunications service provider,
30 advising the caller that the call cannot be completed and must be re-commenced using the device's home equivalent number, and terminating the call.

13. A method as claimed in claim 6 or claim 7, wherein when the roaming number indicates that the device is in neither its home location nor the country in which the call originates:

determining the viability of completing the call to the device location; and

5 if viable, completing the call; or

if not viable:

if the caller is a customer of the telecommunications service provider, advising the caller of a cost of the call if completed and providing an opportunity to cease the call or continue; or

10

if the caller is not a customer of the telecommunications service provider, advising the caller that the call cannot be completed, that it must be re-commenced using the device's home equivalent number, and terminating the call.

15

14. A method as claimed in any of claims 5 to 13, wherein once the step of interrogation is complete, the call is taken out of suspension.

15. A method as claimed in any of claims 6 to 13, wherein the step of routing the call comprises sending it to the roaming number provided as a part of the routing information.

20

16. A method substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

25

17. A system configured to carry out the method of any preceding claim.

18. A system for recognising and routing calls to a mobile telecommunications device capable of roaming across national boundaries comprising:

30

means for recognising a call made to a number relating to a roamable device;

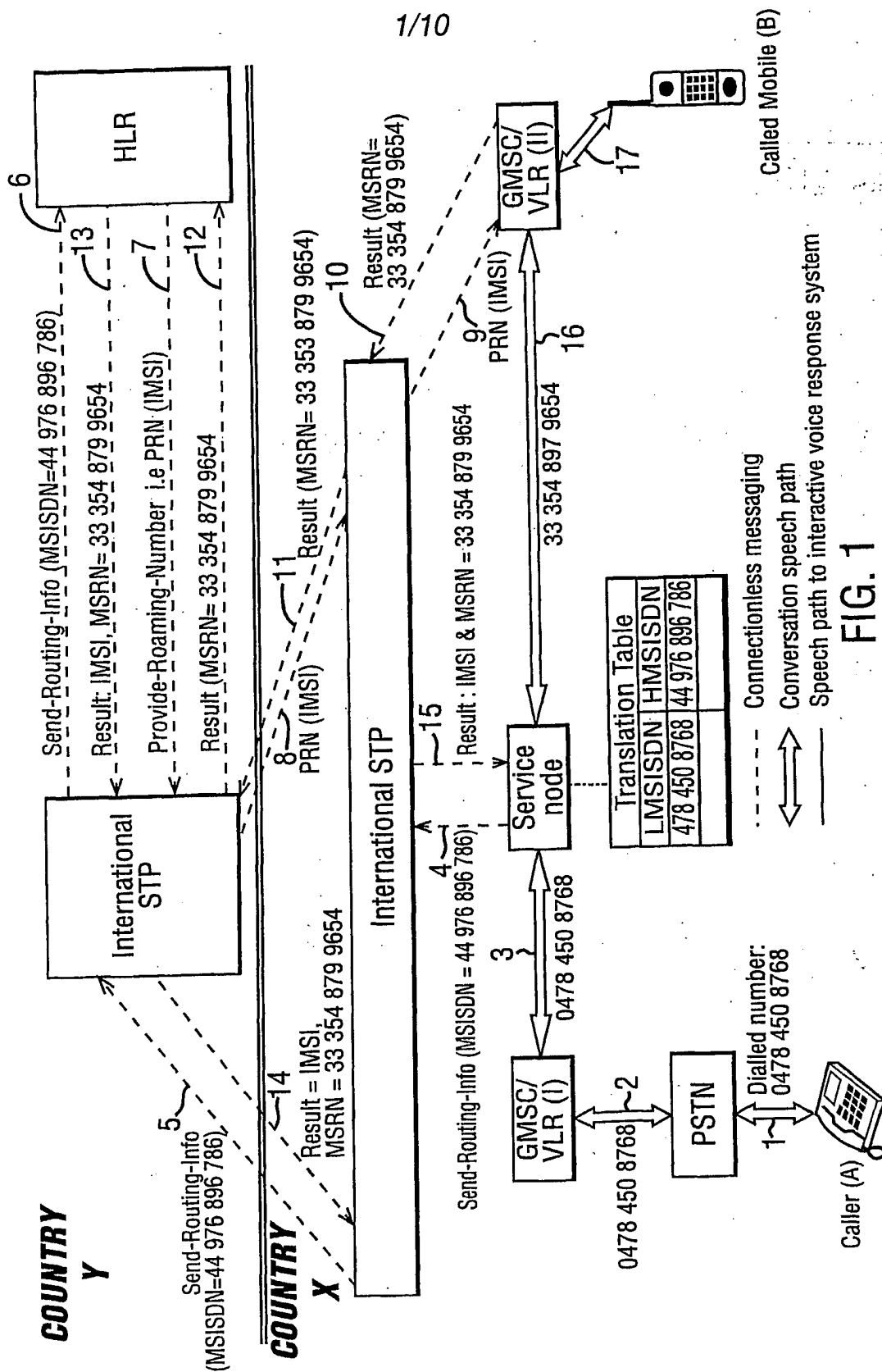
means for trapping and suspending such a call;

means for equating that number with the home number of the device;

means for generating and sending a routing information request, and for receiving a response to the request; and

means for releasing and routing the call.

- 5 19. A system as claimed in claim 18, wherein the means for equating includes at least one look-up or translation table of one or more numbers relating to a device, the home number of the device and a service provider with which the device is registered.
- 10 20. A system as claimed in either claim 18 or claim 19, wherein the mobile telecommunications device is assigned a national number for each nation into which it may roam.
- 15 21. A system as claimed in claim 20, wherein a number is recognisable as an equivalent of a home nation or actual device number by means of a code and/or sequence of digits within the number.
22. A system as claimed in any of claims 18 to 21, wherein each of the means is implemented within a service node consisting of a Mobile (Services) Switching
20 Centre/Visitor Location Register without radio resource functionality.
23. A system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.
- 25 24. A computer program product comprising a computer readable medium having stored thereon computer program means for causing a computer to carry out the method of any of claims 1 to 16.



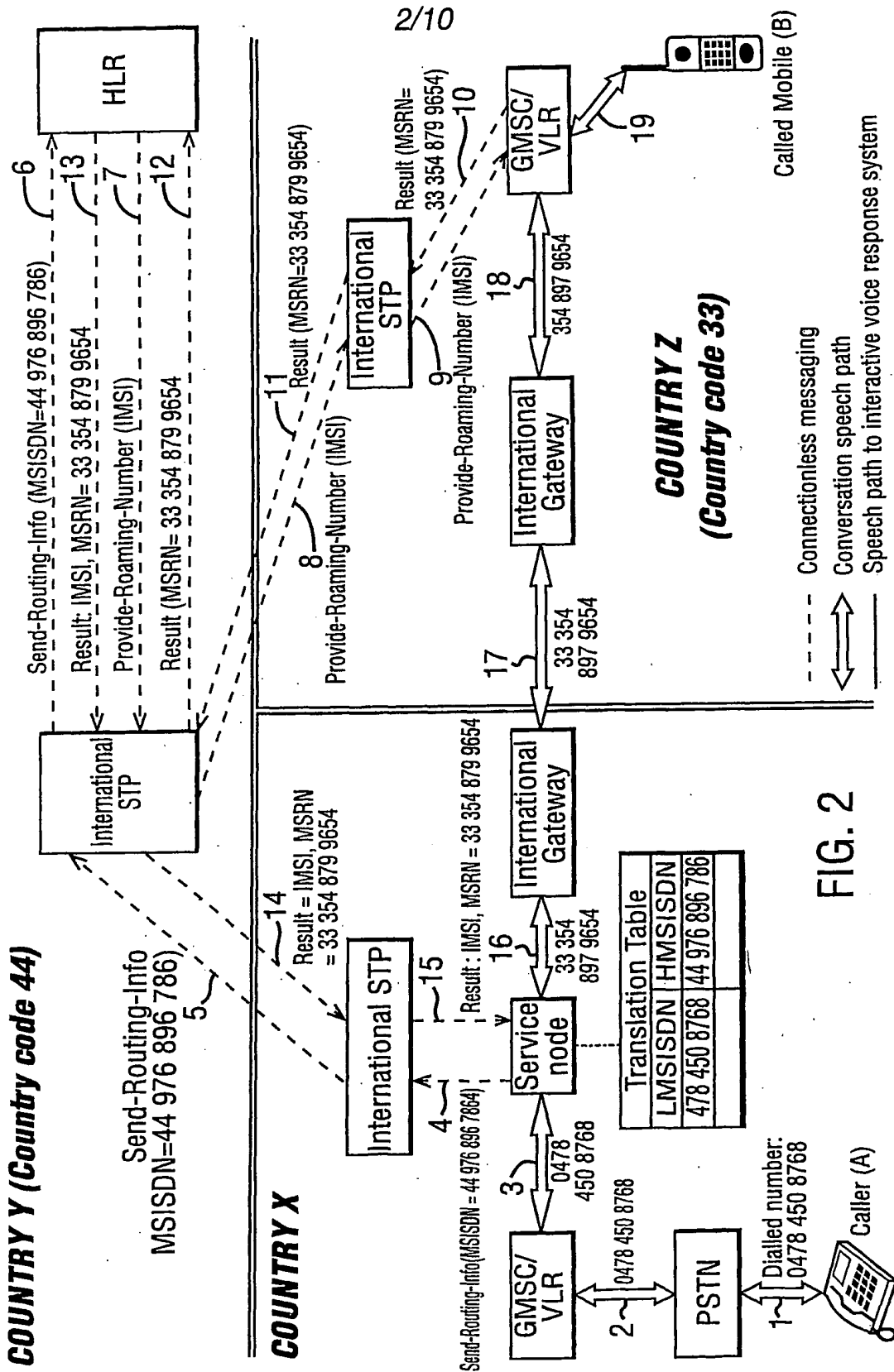
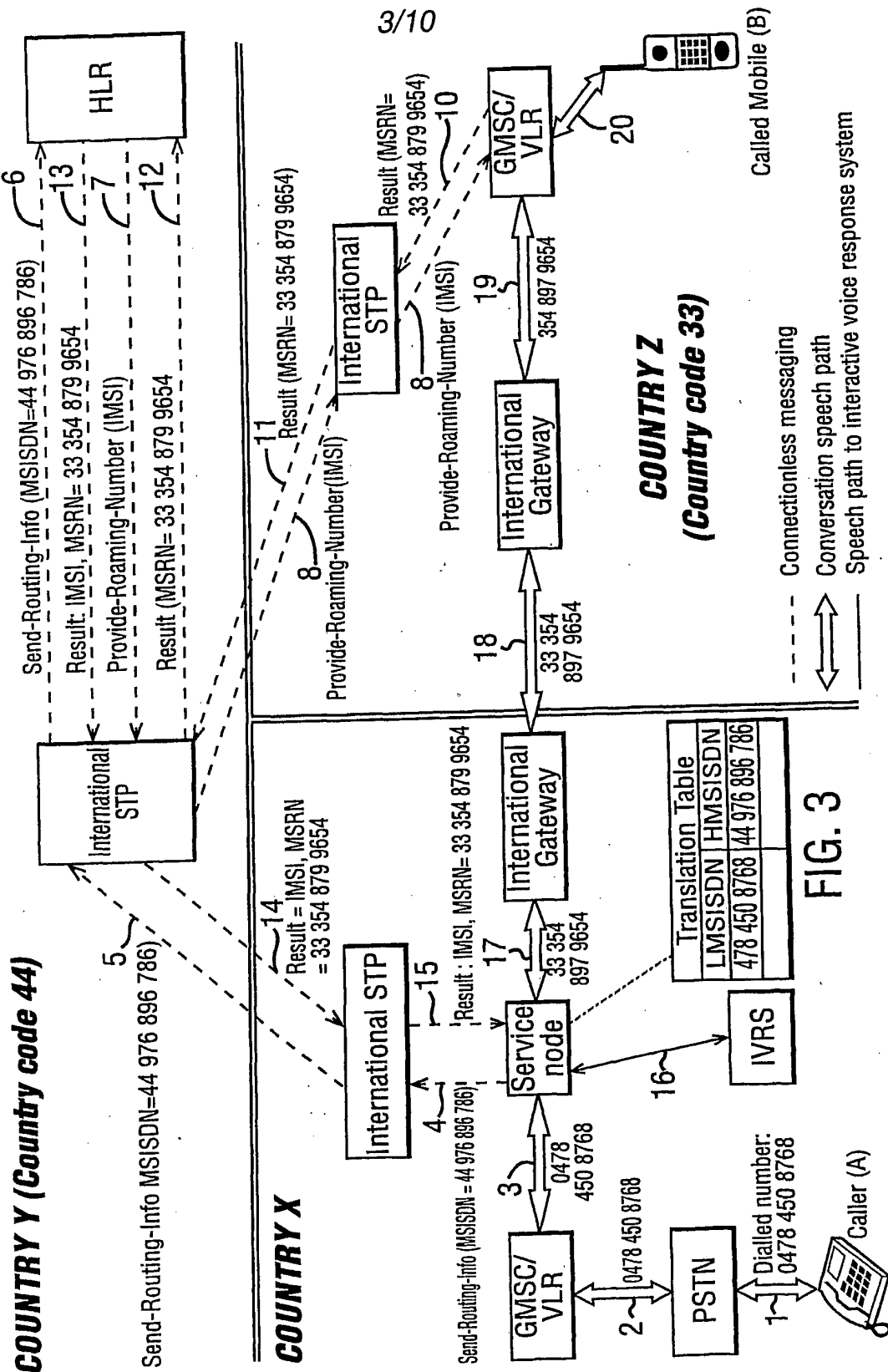


FIG. 2



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FIG. 4

ACMI Inc Springfield UK	
R Runner Director Products	Tel: +44 207 555 1234 Fax: +44 207 555 4321 Mob: +44 787 555 1234

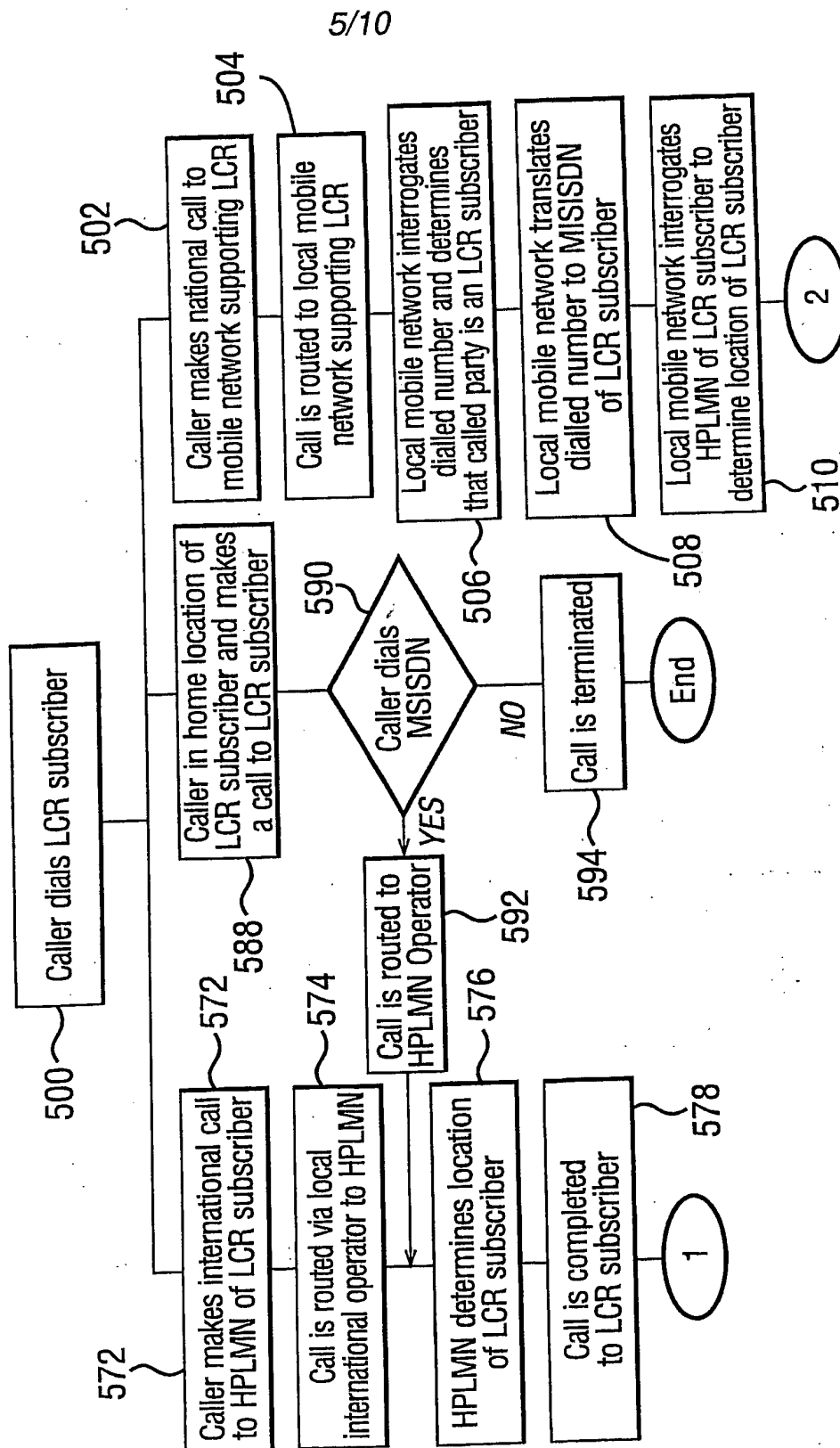
Front

UK	787 555 1234
France	407 245 1254
South Africa	116 459 9245
Singapore	784 3874 345
Australia	483 387 3462
Malaysia	756 387 2873
Hong Kong	863 837 8373

To be charged at local calling rates,
please call me using your local number

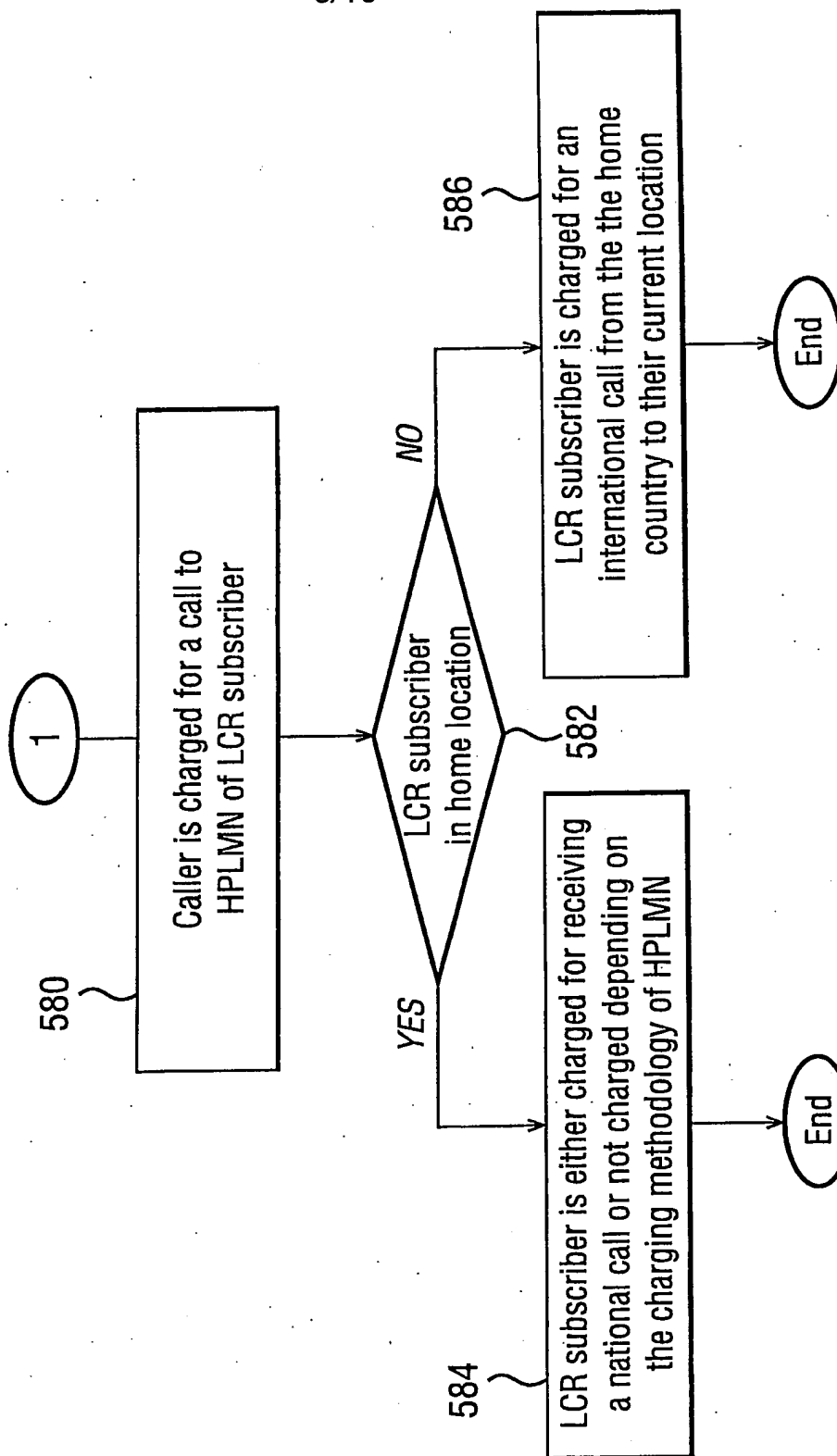
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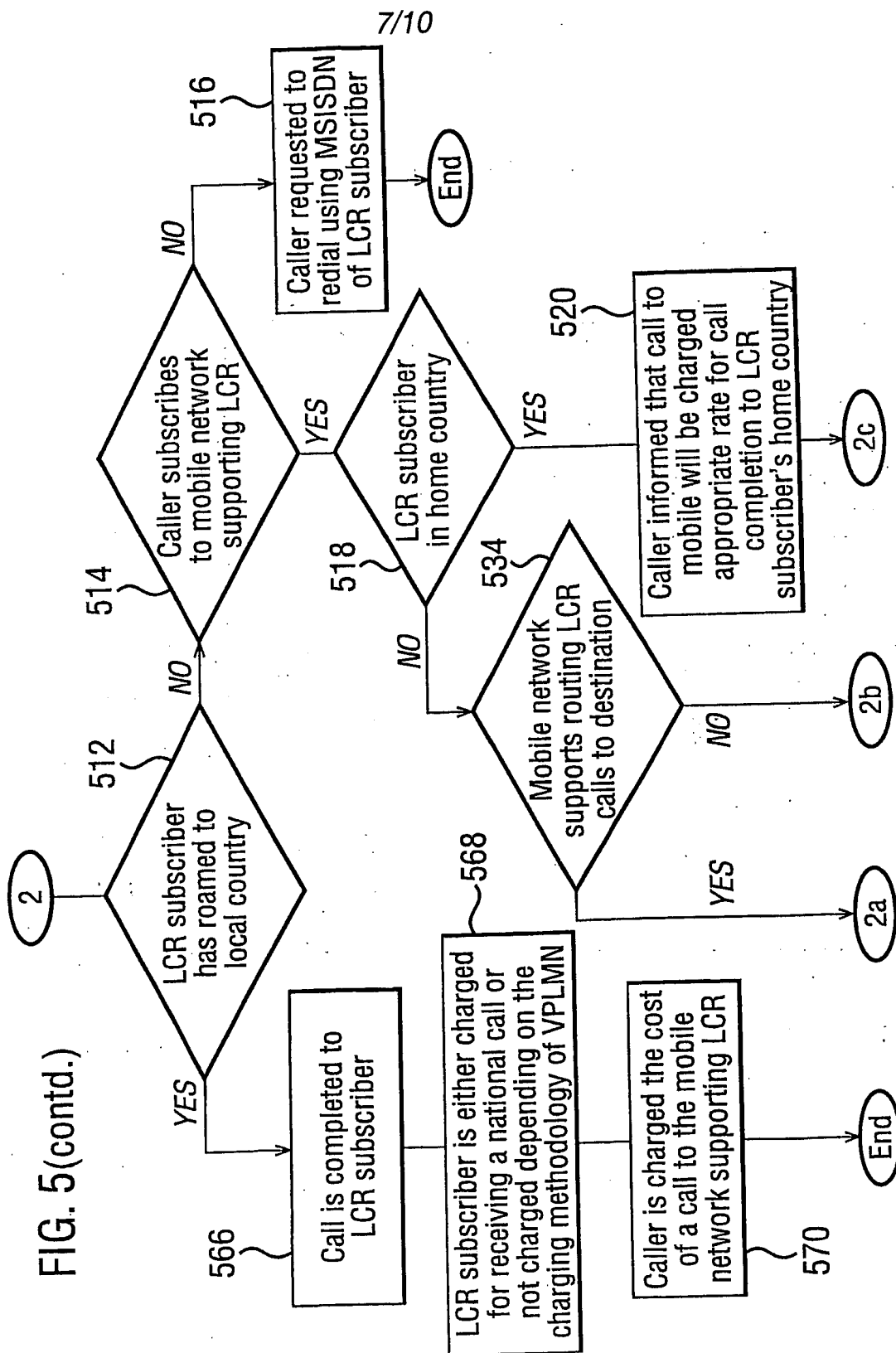
FIG. 5



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FIG. 5(contd.)





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FIG. 5(contd.)

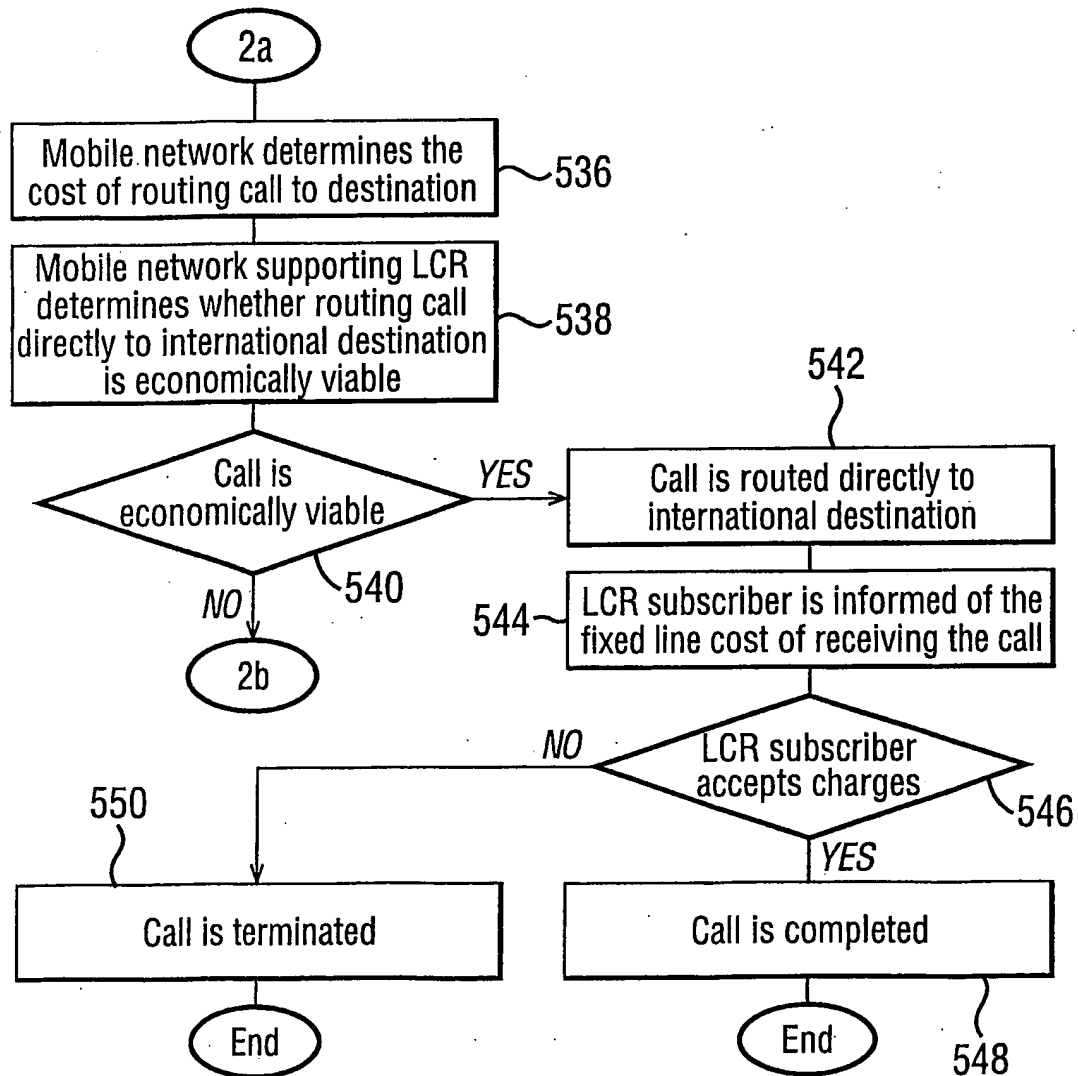
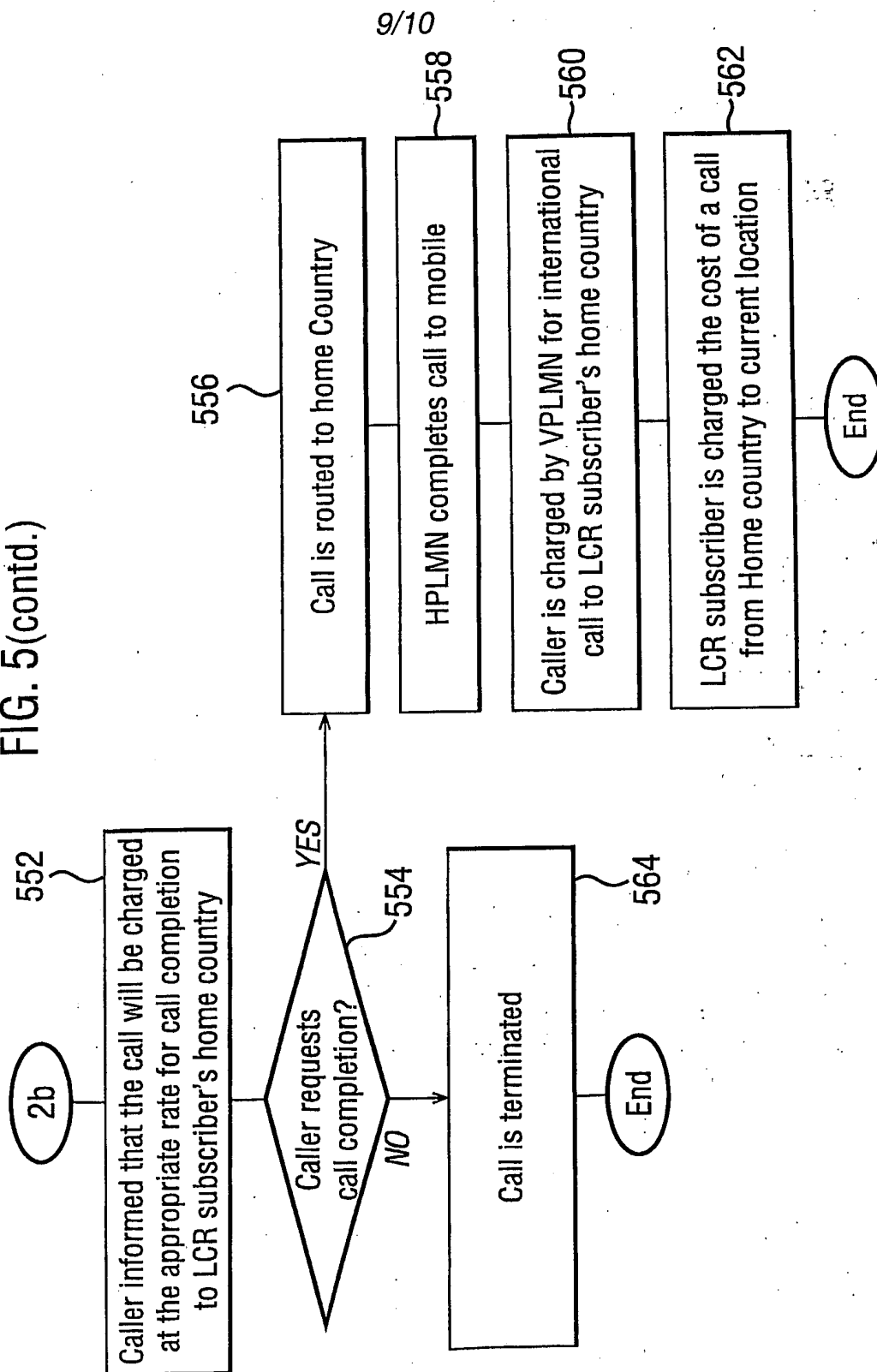


FIG. 5(contd.)



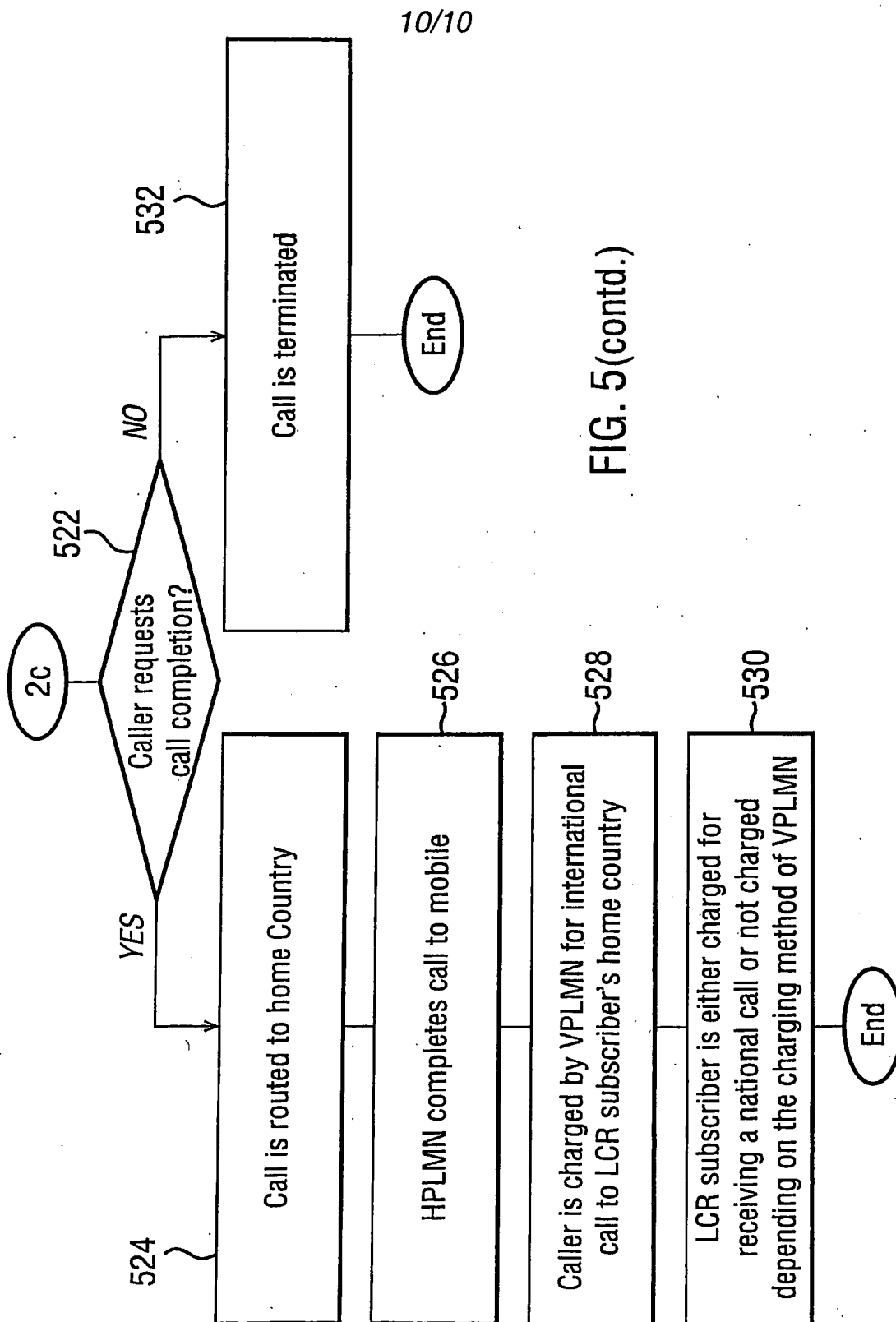


FIG. 5(contd.)

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 02/03900

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 59371 A (ERICSSON INC) 18 November 1999 (1999-11-18)	1,2
Y	page 1, line 5 - line 8 page 3, line 20 - line 21 page 8, line 15 -page 9, line 11 figures 1,4	3-15, 17-22,24
X	WO 99 21386 A (NOKIA TELECOMMUNICATIONS OY ;HAUMONT SERGE (FI)) 29 April 1999 (1999-04-29)	1
Y	page 1, line 2 - line 3 page 3, line 26 -page 4, line 11 page 9, line 6 -page 10, line 33 page 11, line 7 -page 14, line 9 figures 4,9,10	2-15, 17-22,24

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

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- *O* document referring to an oral disclosure, use, exhibition or other means
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- *Z* document member of the same patent family

Date of the actual completion of the international search

15 November 2002

Date of mailing of the international search report

02/12/2002

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 02/03900

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 11752 A (ERICSSON GE MOBILE INC) 19 March 1998 (1998-03-19)	1
Y	page 3, line 29 -page 4, line 17 page 8, line 10 -page 10, line 3 page 11, line 9 -page 13, line 11 figures 3,6,8 ----	2-15, 17-22,24
X	DAVID CROWE: "Optimal Routing: A compilation of Cellular Networking Perspectives articles." CELLULAR NETWORKING PERSPECTIVES, 'Online! January 2001 (2001-01), pages 1-8, XP002220882 Retrieved from the Internet: <URL:http://www.ifast.org/files/IFAST15_00 8_Optimal_Routing.contribution.pdf> 'retrieved on 2002-11-14!	1
Y	page 1, left-hand column, line 26 -middle column, line 15 page 4, left-hand column, line 10 -page 5, middle column, line 27 figures 3,6,7 ----	18,24
P,X	WO 01 65884 A (AITKEN JAMES ;DILLON AIDAN (IE); MARKPORT LTD (IE)) 7 September 2001 (2001-09-07) page 1, line 21 - line 30 page 5, line 10 - line 23 page 6, line 16 -page 8, line 15 page 9, line 4 - line 17 page 10, line 10 -page 11, line 7 figures 1,2 ----	1,2, 18-20,24
A	DE 100 06 819 A (DEUTSCHE TELEKOM AG) 16 August 2001 (2001-08-16) the whole document -----	1-15, 17-22,24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 02/03900

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 16, 23
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB 02 /03900

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 16,23

Independent claims 16 and 23 merely contain a reference to the description and drawings.
Said claims therefore do not meet the requirement following the Article 6 PCT taken in combination with Rule 6 (3)(b) PCT that any independent claim must contain all the technical features essential to the invention. Furthermore, according to Rule 6.2 (a) PCT, references to the description and drawings are allowable only where the reference is absolutely necessary (cf. PCT - Gazette, S-07/1998, C-III, 4.10). Such is, however, not the case here.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 02/03900

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 9959371	A	18-11-1999	AU WO	3555499 A 9959371 A1	29-11-1999 18-11-1999
WO 9921386	A	29-04-1999	FI AU EP WO	973996 A 9543198 A 1025735 A2 9921386 A2	18-04-1999 10-05-1999 09-08-2000 29-04-1999
WO 9811752	A	19-03-1998	US AU BR WO	5991621 A 4347897 A 9711472 A 9811752 A1	23-11-1999 02-04-1998 24-08-1999 19-03-1998
WO 0165884	A	07-09-2001	AU WO	3769001 A 0165884 A1	12-09-2001 07-09-2001
DE 10006819	A	16-08-2001	DE WO	10006819 A1 0160099 A1	16-08-2001 16-08-2001